STATE & PRIVATE FORESTRY
FOREST HEALTH PROTECTION
SOUTH SIERRA SHARED SERVICE AREA

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From: State and Private Forestry, Forest Health Protection, South Sierra Shared Service Area

Subject: 2016 SOFAR Cleveland-Icehouse Forest Health Project

Report Highlights

- *Tree mortality is increasing in areas surrounding the SOFAR Cleveland-Icehouse Project attributed to stand conditions and the current drought.*
- *Tree densities in project area stands are at susceptible levels to tree mortality that would decrease the ability to meet management goals and objectives for this area.*

Location: The Cleveland-Icehouse Forest Health Project (see Figure 1; Appendix A) (C-I project) area is located on the Pacific and Placerville Ranger Districts within the South Fork American River Cohesive Strategy Project Area (SOFAR project). SOFAR project is under the umbrella of the 2011 National Cohesive Wildland Fire Management Strategy. The strategy encourages active collaboration with forest groups, private industries, state and federal agencies, and the public to address local fire issues. Strategy goals are to restore high risk areas to more desired conditions while reducing risk of catastrophic wildfire. The entire SOFAR project area is along the Highway 50 corridor encompassing around 250,000 acres of both Placerville and Pacific Ranger Districts.

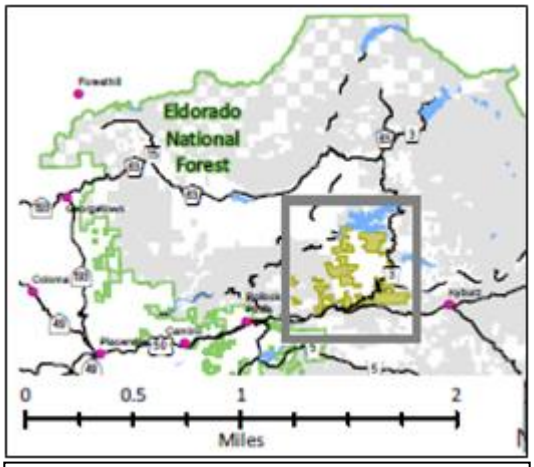

Figure 1. *General location of Cleveland-Icehouse project located within Eldorado National Forest.*

The C-I project encompasses approximately 3000 acres of pine plantations and natural stands. Private industry plantations and other holdings are adjacent to proposed treatment areas. The C-I project is also within an area designated by the Forest Service Chief in November 2015, under Section 8204 of the Agricultural Act of 2014, based on meeting at least one of three criteria:

1. experiencing declining forest health based on annual forest health surveys, *or*
2. at risk of experiencing substantially increased tree mortality over the next 15 years due to insect and disease infestation based on the National Insect and Disease Risk Map[1], *or*
3. in an area in which the risk of hazard trees poses an imminent risk to public infrastructure, health, or safety.

Primary Forest/Cover Types: The project area is composed of several pine plantations (primarily ponderosa and Jeffrey, intermixed with sugar pine) that were established following two significant fires (1959 Ice House Fire, and 1992 Cleveland Fire). The plantations are of variable age classes (25 to 50 + years old) due to their varying years of planting, and some have already had some pre-commercial thinning treatments. There is dense brush understory in younger plantations and drier sites; *Ceonothus* spp., *Rubus* spp., and manzanita primarily. Pines, Douglas-fir, and incense cedars have also seeded in naturally.

Project Objectives: Implement mechanical or hand-thinning treatments to improve growth and vigor of residual trees, create stands that are more resilient to bark beetle-related tree mortality, and reduce risk to catastrophic wildfire. Private industry plantations and other holdings adjacent to proposed treatment areas will be receiving similar treatments as part of the Cohesive Strategy project. Overall density of plantations would be reduced by as much as 50%, below the threshold of imminent mortality for pines (Oliver 1995). Target residual basal areas will range from 60 to 100 ft^2/acre or 60-90 trees per acre, based on landscape position guidelines suggested by GTR 220 (North et al. 2009) and GTR 237 (North 2012). Small gap openings and tree clumps would also be promoted to mimic historical stand conditions, encouraging landscape heterogeneity.

Purpose of FHP Site Visit: Identify forest insects and diseases that threaten objectives of maintaining/improving forest health.

Date(s) of Site Visit(s): On July 1, 2015, we joined in with a field visit with the entire C-I project IDT meeting. Duane Nelson (Placerville District Ranger) and Don Errington (Pacific RD, Silviculturist) led the group to view several of the plantations and natural units proposed for treatment. Below is a table of primary agents noted during the field visit (see Table 1).

Table 1. Primary Pest Agents of concern in and around the Cleveland-Icehouse Proiect areas.

Primary Agents of Concern:	***Tree Species Affected:***
Western Pine beetle	ponderosa pine
Jeffrey pine beetle	Jeffrey pine
Pine engravers (*Ips*. spp)	ponderosa, Jeffrey, sugar
Mountain Pine beetle	sugar pine
Other Agents of interest or Concern:	
Dwarf Mistletoe	Ponderosa, Jeffrey, white fir

[1] The National Insect and Disease Risk Map (Krist et al. 2014) is a based on probabilistic modeling using current stand conditions to assess risk. Risk is defined as the expectation that up 25% or more of the standing live basal area of trees >1 inch in diameter will die over the next 15 years due to insects and diseases.

Observations: Differences between Cleveland vs. Icehouse plantations are easily visible due to differences in age class. Trees in the Icehouse plantations average 18 inches diameter at breast height (DBH) (ranging from 12 to 24 inches) with average basal areas of 220 ft^2/acre (see Figure 2) based on ground surveys. Younger untreated plantations in Cleveland areas have smaller diameters ranging from 4-8 inches and very tight spacing as compared to treated stands (see Figure 3). Icehouse plantations had undergone some previous treatments that reduced tree density to half of that observed in the Cleveland plantations, but tree crowns remain tightly overlapping in all areas and natural in-fill of trees has contributed to higher stocking levels. No beetle activity was noted in the proposed project areas visited in 2015 or in adjacent private land plantations. Plantations along Icehouse Road corridor also had no visible mortality. Across Highway 50, in Pilliken pine plantations south of Kyburz, dwarf mistletoe was found at high infection levels.

Figure 2. *Ice House plantations along White Meadow Road (county road 1041).*

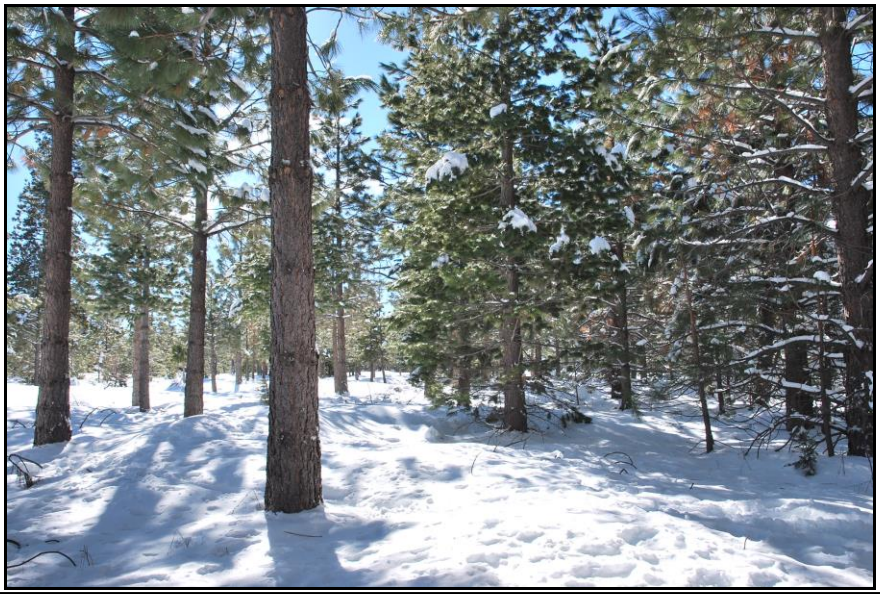

Figure 3. *Cleveland plantations, comparison of thinned (left) vs. unthinned (right) conditions.*

Bark and engraver beetles have been active in natural stands and plantations for the past several years on the Eldorado National Forest, as evidenced by groups of dead trees and individual trees detected by Aerial Detection Surveys (FHM, 2011-2015). Groups range from 5-100+ dead trees and were mostly concentrated in pine plantations. Individual dead trees were generally larger diameter (>15" DBH) ponderosa and sugar pines in natural stands. In the 2015 aerial detection survey, large polygons (>200 acres) of bark beetle-associated mortality were noted east and south of Icehouse Reservoir. Much of this mortality was attributed to fir engraver activity in mixed conifer-white fir forest types, triggered by low precipitation levels observed for the past four years. Acres with mortality almost tripled from 2014 to 2105; number of overall dead trees increased greatly as well.

Aerial Detection Survey Data:
Since 2011 tree mortality detected via annual aerial surveys is listed in Table 2.

Table 2. FHM Aerial Detection Survey Mortality 2011-2015

Pacific and Placerville Ranger Districts	***Acres with some level of mortality***	***Estimated number of dead trees***
2011	6,366	15,000
2012	429	1,300
2013	2,222	6,900
2014	15,042	31,000
2015	44,621	132,000

Precipitation: Bark beetle outbreaks in California are typically triggered by drought. Areas with high tree density or trees not adapted to a site are very susceptible to high levels of mortality during years of below normal precipitation. Stressed trees are suitable host material for bark beetles and their successful colonization results in more beetles and high levels of tree mortality. A dramatic rise in the number of dead trees follows one to several years of inadequate moisture; typically the more severe and prolonged the drought, the greater the number of dead trees. Bark beetles have killed million of trees over the past two years in the southern Sierra Nevada range. For ponderosa and Jeffrey pines moderate physiological drought stress is induced when trees received less than 80% of average precipitation and extreme drought stress occurs when trees receive less than 60% of average precipitation (Grulke 2015). Seasonal precipitation for the Sacramento River hydrologic region (includes the C-I project areas) has been around 85% of the longterm average for the past 4 years likley indicating some level of drought stress for pines and other conifers in this hydrologic region (see Table 3).

Table 3. Percent of seasonal precipitation of Sacramento River Hydrological Region (includes American River) compared to average.

Water Year (determined from October 1- April 30)	*Seasonal precipitation – percent of average.*
2010-2011	135%
2011-2012	80%
2012-2013	90%
2013-2014	55%
2014-2015	75%

National Insect and Disease Risk Map

The bark beetle/host models in the National Insect and Disease Risk Map for CA primarily incorporate three criteria to determine susceptibility to tree mortality: 1) total SDI, 2) % host, and 3) a 3 or 5 year drought frequency. For the western pine beetle/ponderosa pine model each of these criteria are equally ranked and weighted and a constraint is in place that does not allow the model to predict mortality in stands with a quadratic mean tree diameter from 0-6". For SDI the model uses 220 for the onset of mortality and peaks at 365 at which or above, 50% mortality is predicted. For % host, the model is weighted for risk to increase where species composition is 30% or more ponderosa pine. For drought frequency, the model uses a mean of 36 months of precipitation and evaportransporation values for the drought input (See Chapter 6 of SRS-GTR-176 at http://www.srs.fs.fed.us/pubs/gtr/gtr_srs176.pdf). For the Jeffrey pine beetle/Jeffrey pine model no mortality is predicted in stands with a quadratic mean tree diameter from 0-6". For SDI the model uses 210 for the onset of mortality and peaks at 365 at which or above, 40% mortality is predicted. For % host, the model is weighted for risk to increase where species composition is 30% or more Jeffrey pine. For drought frequency the model uses a mean of 60 months for the drought input. Each criteria are equally ranked and weighted.

Based on the stand data from the project area, these stands are at risk to bark beetle-related tree mortality based on the applicable models used in developing the 2012 National Insect and Disease Risk Map and thus meet Criteria 2 (*see page 1 of this report*) under Section 8204 of the Agricultural Act of 2014 (see Appendix B and C). Increases in observed tree mortality over the past few years since 2011 indicate that bark beetles are very active in the Forest, continuing into 2016. In addition, we are observing <80% mortality in pine plantations in the Southern Sierra Nevada range forests. Treating stands will reduce the likelihood of high levels of tree mortality in the future

Management Options:

Do nothing.

As competition from brush and trees increases tree mortality caused by bark and engraver beetles will occur and be exacerbated during drought conditions.. Depending on the insect involved, mortality may occur in groups of trees or as individual trees scattered across the project area; this would also equate to additional standing and down fuels. Some mortality may be desired for wildlife habitat and other values however doing nothing will likely result in the overall inability of land managers to meet their goals and objectives for this area.

Conduct thinning treatments to reduce/prevent tree mortality.

Treatments that reduce stocking levels or densities below thresholds appropriate for forest type and site, would significantly reduce the potential for tree mortality from bark beetle and engraver beetles. The criteria used in the host/insect models in the 2012 NIDRM were informed based on results of research that examined thinned vs untreated stands and subsequent levels of tree mortality. Bark beetle-associated mortality is positively correlated with increasing basal area or SDI (Oliver and Uzoh 1997, Fettig et al. 2007, Zhang et al. 2013, *several others available upon request)*.

The objectives of preventive thinning would be to increase the growth and vigor of residual trees, and prevent/reduce mortality caused by bark and engraver beetles. Trees would be

selectively removed to meet the desired basal area of 60 to 100 ft^2/acre. An additional benefit of the thinning treatment would be more space between trees and an altered fuel profile associated with risk of wildfire.

Icehouse Plantations will receive similar treatments to the Cleveland plantations. A large percentage of the trees are less than 2 inches DBH, but some are greater than 12, and up to 24 inches DBH. Proposed units would be reduced by 30% to around 90 residual trees per acre, down from 248 tees/acre. . Prescription criteria will retain largest trees, with preference to pines and oaks.

It is recommended that residual cut green limbs/boles be limited in the area, particularly in the vicinity of live trees; this will lower attraction of beetles into the area.

Prescribed Fire.

Caution should be taken in units if prescribed burning will be implemented. Trees are already drought-stressed and the additional stress of fire injury may result in increased levels of tree mortality or may initiate bark beetle activity..

If there are any questions or more information is required regarding this report, please do not hesitate to contact Forest Health Protection.

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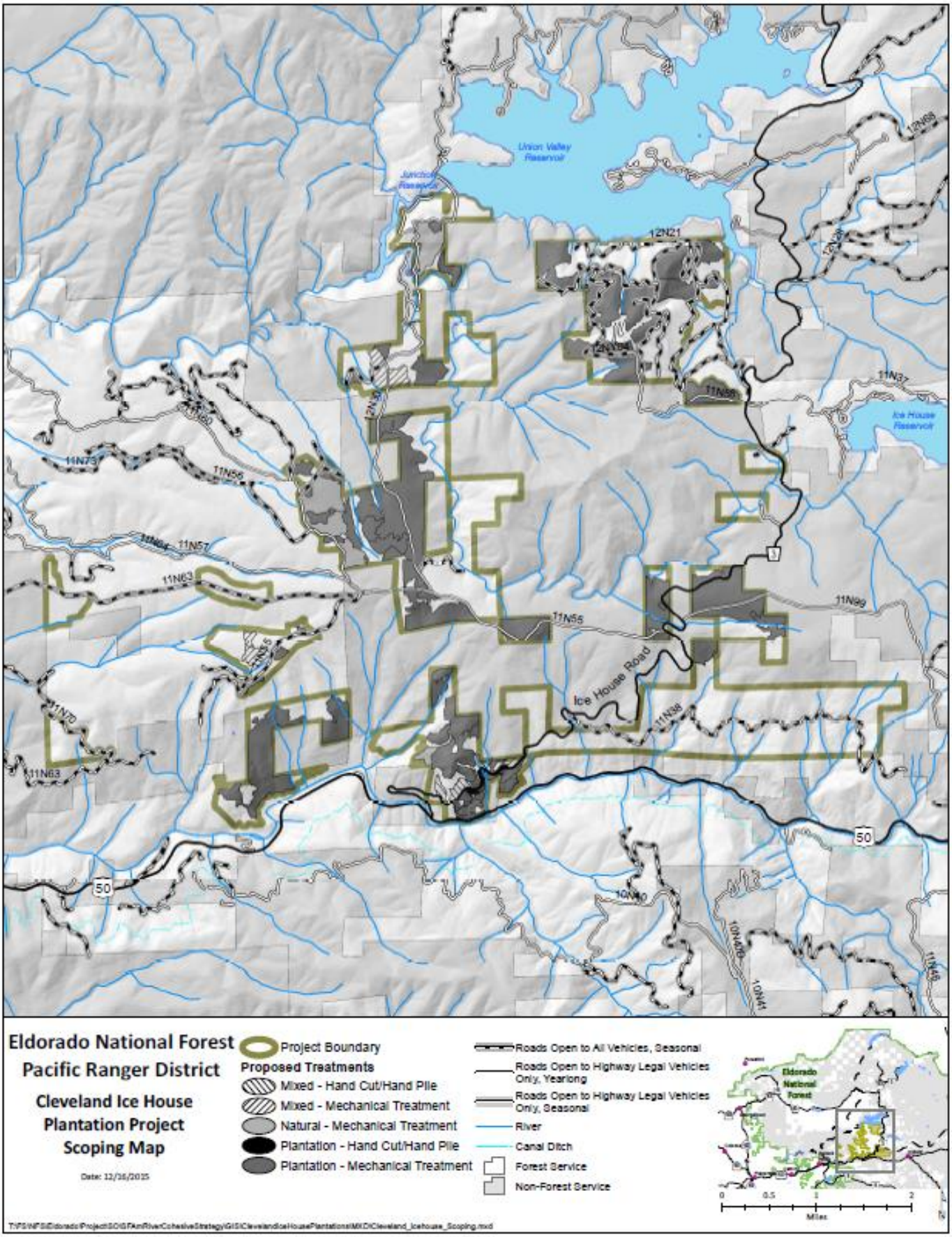
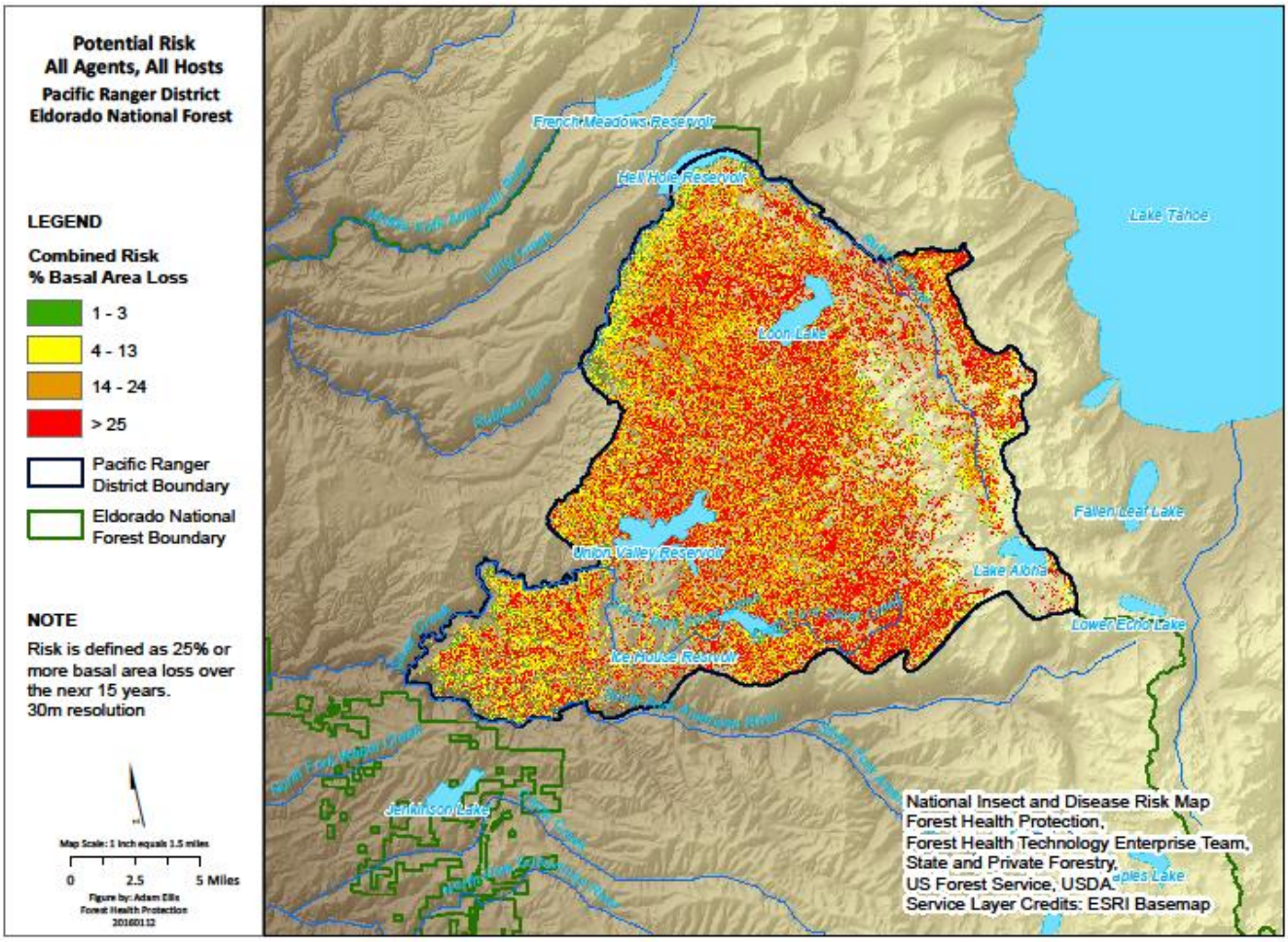
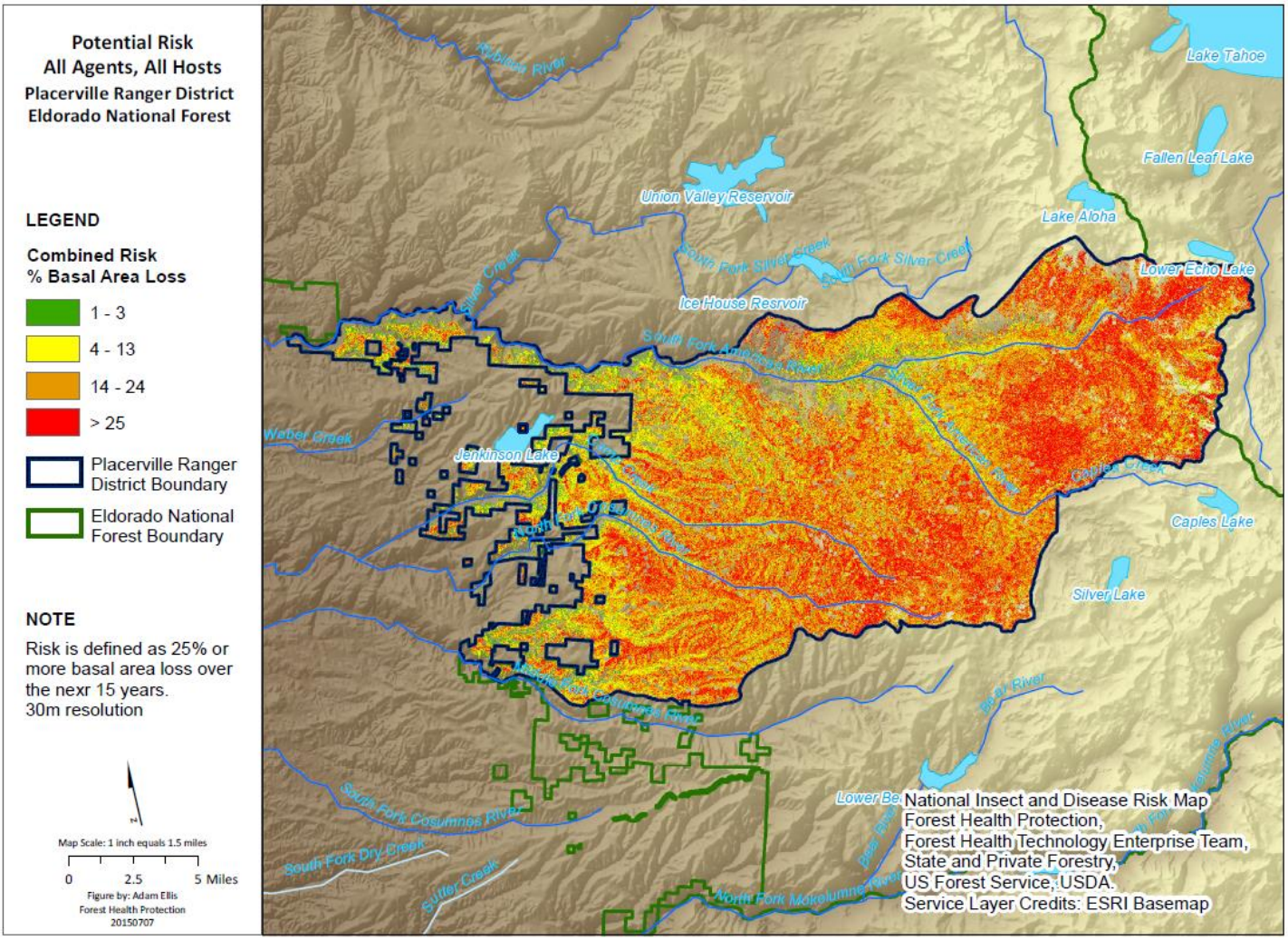
Appendix A. Map of proposed units for Cleveland-Icehouse Forest Health Project 2016.

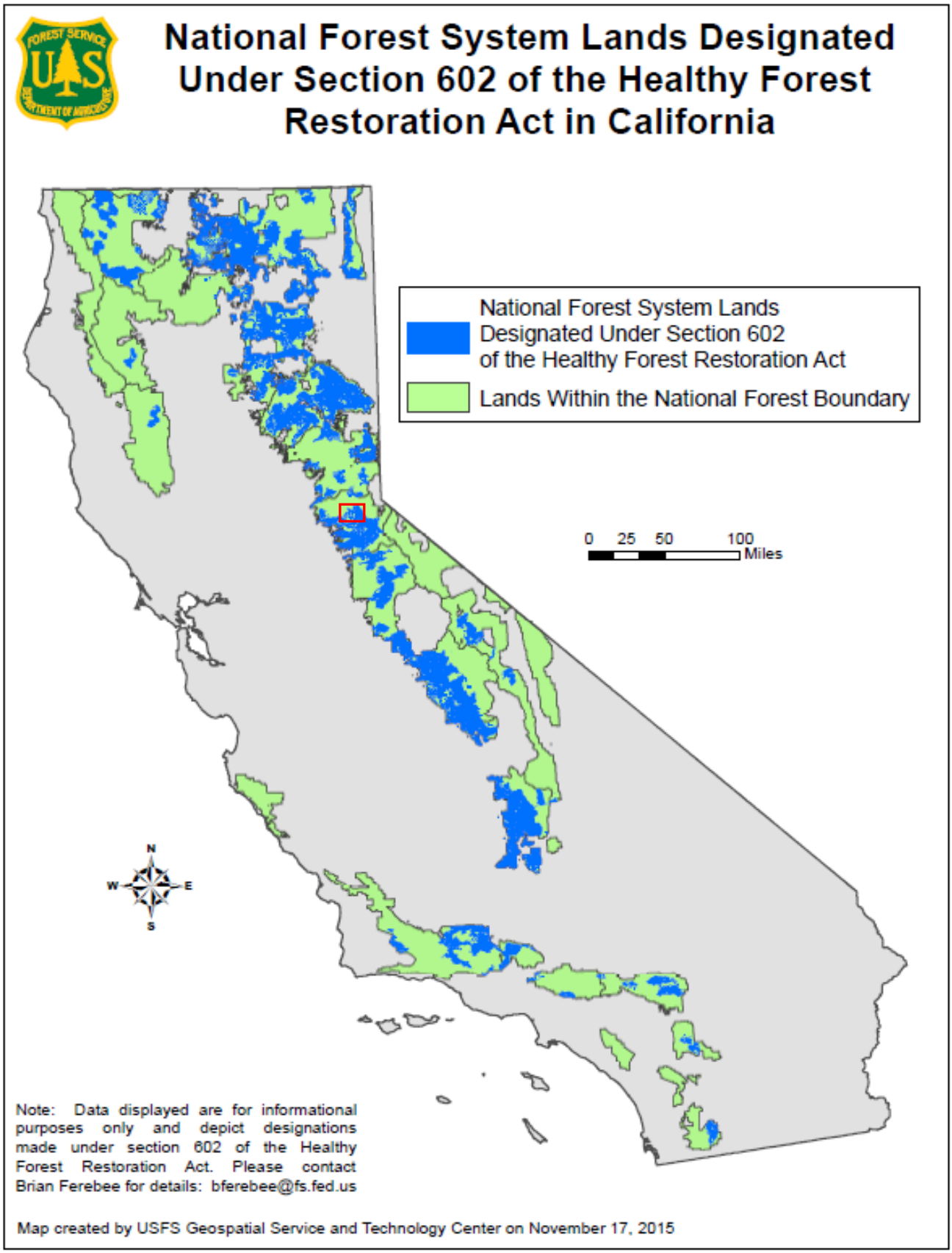


Appendix B. Insect and Disease Risk Map of Pacific Ranger District. *Note: a large portion of Cleveland-Icehouse Project is within Pacific Ranger District.*



Appendix C. Insect and Disease Risk Map of Placerville Ranger District.




National Forest System Lands Designated Under Section 602 of the Healthy Forest Restoration Act in California
National Forest System Lands Designated Under Section 602 of the Healthy Forest Restoration Act
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Note: Data displayed are for informational purposes only and depict designations made under section 602 of the Healthy Forest Restoration Act. Please contact Brian Ferebee for details: bferebee@fs.fed.us
Map created by USFS Geospatial Service and Technology Center on November 17, 2015

Note: Red square denotes general location of Cleveland-Icehouse Forest Health Project, Pacific Ranger District, Placerville Ranger District, Eldorado National Forest.